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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Development of Siberian and Dahurian Larches After 10 Years in North Dakota

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A 10-year test of trees grown in North Dakota from three Siberian larch, one Dahurian larch, and two hybrid larch seed sources indicated that trees from two Siberian origins may be suitable for windbreak plantings in the northern Great Plains.

Keywords: Larix sibirica, provenance test, shelterbelt plantings.

Siberian larch (Larix sibirica Ledeb.) has not been planted extensively in Northern Great Plains windbreaks, although limited trials indicated it may be well suited for windbreak plantings.² Potentially a large tree, Siberian larch could be used as the tallest member of a multiple-row shelterbelt. In trials at Indian Head, Saskatchewan, block plantings of Siberian larch attained 66 feet in height and 9.1 inches diameter at breast height 56 years after planting.³

Limited trials with Dahurian larch (Larix gmelini (Rupr.) Litvin.) have indicated the origins tested were not suitable sources of seed for planting in North Dakota.²

Siberian and Dahurian larch also have considerable ornamental value as a result of their deciduous growth habit, unique among the conifers. Their seasonal change of foliage from a pale green in the spring to a pastel

yellow in the autumn makes them highly desirable where esthetic appeal is of high priority.

To investigate further the potential of Siberian and Dahurian larches for windbreaks, the Lake States (now North Central) Forest Experiment Station initiated a seed source study in 1961.

Methods

Seeds of Larix sibirica, L. gmelini, and L. sibirica x gmelini, representing six different origins, were collected in 1954-56 in the U.S.S.R. (fig. 1). They were sown in the spring of 1957 in the Hugo Sauer Nursery of the USDA Forest Service, near Rhinelander, Wisconsin (table 1).

The stock was lifted as 2-2 transplants in the spring of 1961 and shipped to the Denbigh Experimental Forest, North Dakota, for field planting. The trees were planted at a spacing of 14 by 14 feet in square 4-tree plots replicated 10 times in a random complete-block design. White spruce (Picea glauca (Moench) Voss) 2-2 transplants (Black Hills seed source) were interplanted as fillers to reduce the overall spacing to 7 by 7 feet. The soil was a deep loamy sand with a depth to water table of approximately 10 feet. The ground cover of native grass was plowed and disked in the year prior to planting, and was disked again immediately before planting.

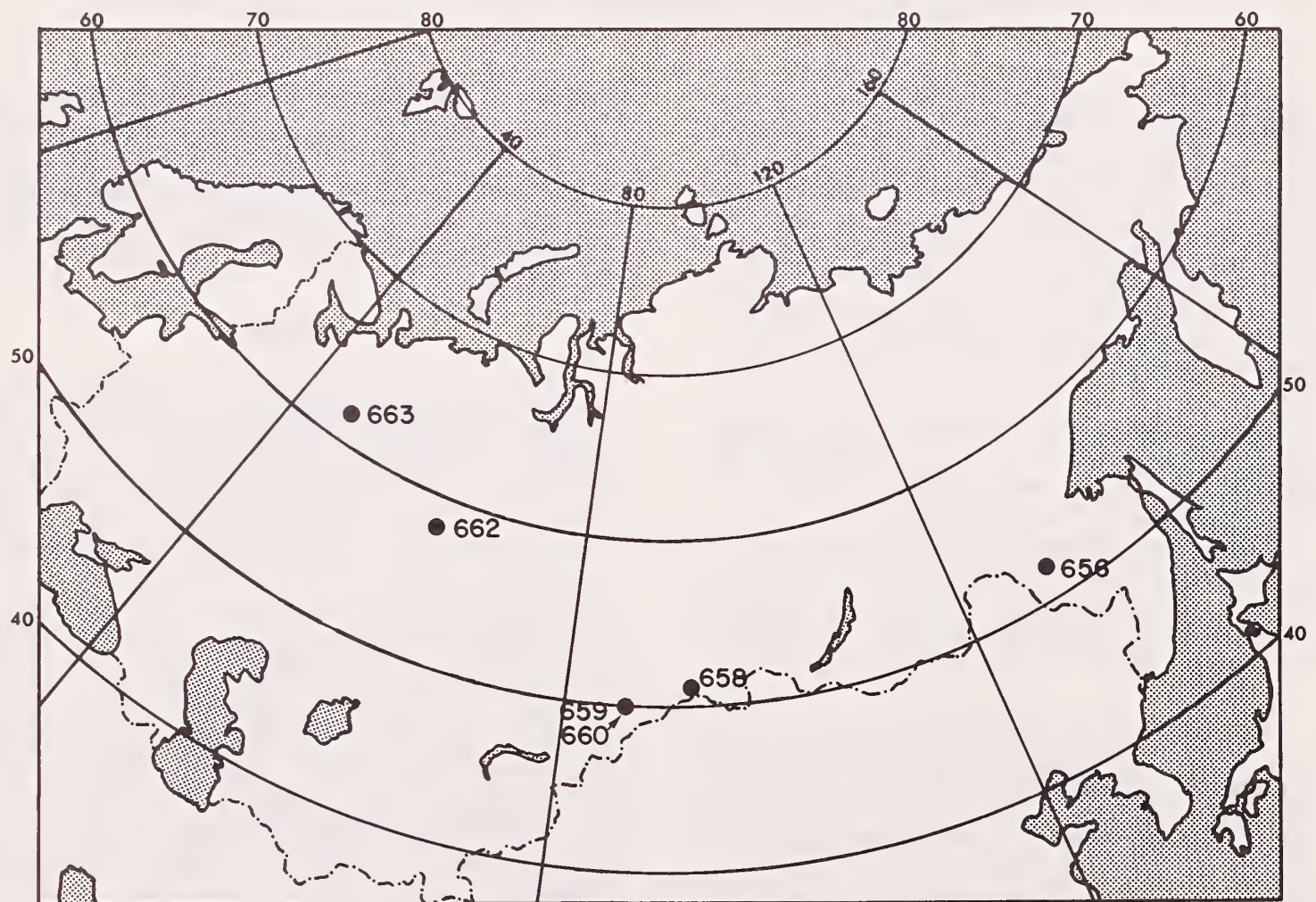
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² George, Ernest. *Tree and shrub species for the Northern Great Plains*. U.S. Dep. Agric. Circ. 912, 46 p. 1953.

³ Cram, W. H., A. C. Thompson, and C. H. Lindquist. *Nursery production investigations*. p. 24. In *Summary Report for the Tree Nursery, P.F.R.A., Canada Dep. Agric., Indian Head, Saskatchewan*. 1964.

Table 1.--Origins of larch seed collections.

Seed source number	<u>Larix</u> species	Locality of origin	North latitude	East longitude
656	<i>gmelini</i>	Amurskaya Province, Mazonovski Dist., Mazonovski Forest; elev. 200 m.	51°31'	129°
658	<i>sibirica</i>	Tuvinskaya Autonomous Prov., Barun.-Khemchikski Dist.	51°	92°
659	<i>sibirica</i>	Altaiskaya Mountain Autonomous Prov., Upper Katunski Forest; elev. 1600 m.	50°	86°
660	<i>sibirica</i>	Altaiskaya Mountain Autonomous Prov., Upper Katunski Forest; elev. 1300 m.	50°	86°
662	<i>sibirica</i> x <i>gmelini</i>	Sverdlovskaya Prov., Sinyachikhinski Dist., Trans-Urals; elev. 150 m.	58°	62°
663	<i>sibirica</i> x <i>gmelini</i>	Arkhangelskaya Prov., Upper Toemski Dist., Vyiski Forest	62°	46°

Figure 1.--Locations in U.S.S.R. of the six origins of *Larix* seed.

The planting stock had broken dormancy before it was lifted from the nursery in Wisconsin. Terminal and lateral buds had swollen and new foliage had appeared.

Weather conditions at the time the trees were planted were nearly ideal, but drought conditions prevailed throughout most of the growing season in 1961. The effects of this drought, combined with those due to early flushing, resulted in poor survival the first year. Replanting in 1962 and 1963 replaced some of the early losses, but there was insufficient planting stock to replace them all. Damage and losses from deer browsing and rubbing have also reduced the growth and survival of trees in the plantation.

Results

Survival

Trees of the Larix gmelini source and of one L. sibirica x gmelini hybrid source survived very poorly and were each represented by only one remaining tree (table 2). Survival of trees

from the other hybrid seed source averaged 20.0 percent. Trees of the Larix sibirica seed sources from Tuvinskaya Province (658) and from Altaiskaya Mountain Province (659) survived moderately well. Trees of another seed source from a slightly lower elevation in Altaiskaya Mountain Province (660) suffered high mortality. Such survival differences among trees from narrowly separated origins emphasizes the importance of choosing a suitable seed source from a relatively limited geographic area.

Growth

Only three of the six origins were represented by sufficient numbers of trees to be included in an analysis of variance of total height and leader growth (table 2).

Differences among seed source means for total height and leader growth were not significant. Trees of Larix sibirica from the Tuvinskaya Province averaged the tallest and produced the most leader growth. Trees from the other two origins ranked nearly the same.

Table 2.--Percent survival and mean growth of two larch species and their naturally occurring hybrid 10 years after planting on Denbigh Experimental Forest, North Dakota

Seed source number	Number planted including replants	Survival	Growth	
			Total height	Leader (1970)
		Percent	Feet	Feet
659	65	^{1/} 42.2 a	6.9	1.6
658	79	33.0 ab	7.9	2.2
662	68	20.0 bc	7.1	1.5
660	40	7.5 cd	(^{2/})	(^{2/})
663	40	2.5 cd	(^{2/})	(^{2/})
656	80	1.1 d	(^{2/})	(^{2/})

^{1/} Numbers followed by the same letter suffix (a, b, c, or d) do not differ significantly at the 5 percent level (Duncan's multiple range test).

^{2/} Insufficient survival to provide meaningful values.

Conclusions and Recommendations

Although the overall survival of the plantation was poor (17.7 percent), trees from two of the Larix sibirica origins survived adequately and can be considered suitable sources of future seed supplies for windbreak plantings of this species in the Northern Great Plains. Trees from the Larix gmelini and L. sibirica x gmelini origins survived very poorly and cannot be recommended, on the basis of this test, for further use in this region.

Total heights after 10 years in the field are unimpressive, but the averages for current growth are encouraging. The average height growth of 1.5 to 2.2 feet likely represents a minimal estimate of the growth potential of Larix sibirica. Many of the trees measured had been heavily damaged by deer for several years in succession. Such damage not only reduced measurable current-year growth, but more importantly, reduced the tree's vigor and subsequently its growth the following year.

Some trees with terminal leaders above the deer browse-line put on spectacular growth. One individual from source 658 grew 4.49 feet in 1970. Preferential browsing by deer among seed sources was not evident.

The results reported here are based on only a limited number of seed origins. The difficulty in procuring a representative sample of seed sources from the natural range of Larix sibirica makes it nearly impossible to conduct a comprehensive provenance study of the species. Problems in identifying the precise origin of seeds introduced earlier into the United States and Canada further complicate attempts to study variation in Larix sibirica.

Some of the trees in this study have begun to produce cones. Attempts will be made to locate as many other origins of Larix sibirica as possible for inclusion in a breeding program designed to improve the suitability of this promising species for windbreak planting in the Northern Great Plains.